4.3. Habitat Assessment

Management Measure for Habitat Assessment:

Site and design marinas to protect against adverse effects on shellfish resources, wetlands, submerged aquatic vegetation, or other important riparian and aquatic habitat areas as designed by local, state, or federal governments.

Management Measure Description

The construction of a marina in any waterbody can disrupt aquatic habitats. This management measure is important because of the value of protecting natural habitats so they continue to provide food and recreational opportunities for people, as well as food and shelter for plants and animals, and so their roles in the ecological health of waterbodies are protected. Past waterfront development has adversely affected many waterbodies, but our knowledge of ecology has increased. We now realize the importance of healthy aquatic habitats to both our health and the overall health of our waterbodies. Efforts to decrease the introduction of invasive and exotic species have increased, and minimizing pollution in waterbodies is widely accepted as a sound ecological and economic practice. In many cases, federal and state laws require analyses of the potential impacts on the natural environment before projects begin. This management measure focuses on marina siting and design and extends to assessments of how marinas can incorporate natural habitats into their siting and design.

When well designed and cared for, marinas can be a valuable habitat for plants and animals that are adapted to quiet, sheltered waters. Regardless of the type of waterbody on which a marina is to be constructed, siting it where its development or operation will diminish the biological or economic value of the surrounding habitats should be very carefully considered, especially if the potential site is near locations that have been given special designations by local, state, or federal governments. Such habitats might be fish spawning areas, shellfish harvesting areas, designated wetlands, beds of submerged aquatic vegetation (SAV), or areas where threatened or endangered species are known to occur. If a marina is properly designed and located, aquatic plants and animals should be able to continue to use the marina waters for the same activities (e.g., reproduction or feeding) that occurred in the waters before the marina's presence.

Marinas that have been operating for a while can provide sheltered, quiet waters for plants and animals that prefer this type of environment or for animals that need this type of environment during specific life stages, such as spawning. Where the surrounding environment has been developed and offers little in the way of natural habitat, such as in an urbanized waterfront district, a marina might provide a refuge for many species. A pollution prevention and control program, based on the management measures presented in this guidance, can help maintain or improve water and habitat quality for aquatic species.

The locations of all important aquatic and riparian habitats in a locality or waterbody might not be known. A visual survey by a biologist may be appropriate before any marina construction or expansion begins, and a specialist in aquatic habitat restoration can be contacted if marina management is considering modifying the marina to create good aquatic habitat in the marina basin. Geographic information systems (GIS) are being used increasingly to map biological resources in many states and show promise as a method of conveying important habitat and other siting information to marina developers and environmental

protection agencies. The state department of environmental protection or natural resources can be contacted for this type of information.

Applicability

This management measure is applicable to new and expanding marinas where site changes might affect wetlands, shellfish beds, aquatic vegetation, or other important aquatic resources or habitats.

Best Management Practices

♦ *Conduct habitat surveys and characterize the marina site, including identifying any exotic or invasive species.*

The first step in constructing a marina that will be compatible with the surrounding natural environment or expanding or modifying an existing marina to create a more natural environment is to characterize the environment of the proposed site or operational marina. Before marina development or expansion, critical or unique habitats, such as beds of submerged vegetation and shellfish beds, should be identified. The importance of the area that will be affected by development to aquatic organisms for spawning, feeding, or their overall survival should be assessed within the context of the entire waterbody (Figure 4-6). Equally as important, exotic plants and animals that could be problematic for marina operation should be identified. Table 4-1 lists some common exotic and invasive aquatic species in the United States. Once the site has been characterized, marina development or expansion can proceed in a way that minimizes adverse effects on aquatic life and habitats.

♦ *Assess habitat function (e.g., spawning area, nursery area, feeding area) to minimize indirect effects.*

An area proposed for marina development or expansion could be used seasonally by fish or other animals. Animals use special areas of many coves, shorelines, beds of submerged vegetation, rivers, streams, and estuaries for short periods of time—from a few nights to weeks—for particular life functions such as migration, spawning, and rearing young. Marinas can accommodate these special, short-term uses if marina designers and managers are aware of the need for the areas and the marina is built with the needs in mind.

Figure 4-6. Habitat assessment was used at Elliot Bay Marina (Washington) to design the marina to work with natural habitat function. Wide openings between rock groin-type breakwaters, docks, and beach give easy access to migrating juvenile salmon leaving Puget Sound, while providing good water circulation and tidal changes inside the marina basin. A man-made 1,500-foot-long sandy beach has replaced lost habitat, providing a feeding ground for young salmon. Schools of young salmon and herring move throughout the marina basin (USEPA, 1996: *Clean Marinas—Clear Value*).

♦ *Use rapid bioassessment techniques to assess effects on biological resources.*

Rapid bioassessment techniques, where they have been developed, provide cost-effective biological assessments of potential marina development sites. Rapid bioassessment uses biological criteria (usually invertebrate and fish populations) as indicators of the condition of a habitat. To apply rapid bioassessment to a marina development site or an operating marina, select biological communities at the proposed site or the operational marina are compared to the same biological communities at an undisturbed site in the same waterbody or a similar one. The biological health of the proposed site or marina basin is rated based on how favorably the invertebrate or fish communities there compare with those of the undisturbed site. Scores from rapid bioassessments are useful for determining whether a site is stressed by pollution or other factors, such as habitat alteration. Rapid bioassessment protocols for macroinvertebrates and fish in freshwater streams and rivers are being developed by many states, and a document on them is available from EPA at the web address

Table 4-1. Common Invasive and Exotic Species of the United States

Species	Distribution	Problems caused	Control Methods	Additional Information
Crustaceans				
Spiny water flea *Bythotrephes cederstroemi*	Throughout the Great Lakes and in some inland lakes	May compete directly with young perch and other small fish for food, such as *Daphnia* zooplankton; may wind up unseen in bilgewater, bait buckets, and livewells; fishing lines and downriggers are often coated with both eggs and adults	The spread of all exotic and invasive species can be controlled by: 1. Removing aquatic plants and animals from boats and trailers, including the anchor, trailer rollers and axle, propeller, and boat hull. 2. Draining all lake, bay, ocean, or river water from the boat before transporting it to another waterbody. 3. Disposing of any unwanted live bait on land. 4. Rinsing the boat and all equipment with high-pressure, hot water, especially if moored for more than a day. **OR** Drying everything for at least 5 days before putting the boat into another waterbody.	http://www.sg.ohio-state.edu/publications/nuisances/bythotrephes/fs-049.html http://www.sg.ohio-state.edu/publications/nuisances/bythotrephes/fs-049.html
Mollusks				
Zebra mussel (*Dreissena polymorpha*)	All of the Great Lakes and waterways in many states, as well as Ontario and Quebec; Map: http://nas.er.usgs.gov/images/currzm00.gif	Fouls underwater structures and intake pipes; can spread from one waterbody to another on trailered or transported boats; microscopic larvae may be carried in livewells or bilgewater; adults can attach to boats or boating equipment that is in the water		http://www..seagrant.unm.edu/exotics/fieldguide.html
Asian clam (*Corbicula fluminea*)	Found in 38 states. Map included on: http://nas.er.usgs.gov/mollusks/docs/co_flumi.html	Cause biofouling; cause problems in irrigation canals and pipes and drinking water supplies; alter benthic substrate and compete with native species for limited resources; currently introduced through bait buckets, passive movement via water currents, intentional introduction as a food item in markets		http://nas.er.usgs.gov/mollusks/docs/co_flumi.html http:/lionfish.ims.usm.edu/%7Emusweb/nis/Corbicula fluminea.html
Plants				
Eurasian Watermilfoil (*Myriophyllum spicatum*)	Map included on: http://nas.er.usgs.gov/plants/docs/my_spica.html	Form thick underwater mats of stems and vegetation, crowding out native water plants; may be spread by becoming entangled in boat propellers (a single segment of stem and leaves can take root and form a new colony)		http://nas.er.usgs.gov/plants/docs/hy_spica.html
Hydrilla *(Hydrilla verticullata)*	Map included on: http://nas.er.usgs.gov/plants/docs/hy_verti.html	Grows aggressively and forms thick mats in surface waters, blocking sunlight to native plants; alters physical and chemical characteristics of lakes; reduces foraging efficiency; affects water flow and water use; mainly introduced to new waters as castaway fragments on recreational boat motors and trailers and in livewells		http://nas.er.usgs.gov/plants/docs/hy_verti.html
Purple loosestrife *(Lythrum salicaria)*	All contiguous U.S. states except Florida; Map included on: http://www.dnr.cornell.edu/bcontrol/purple.htm	Rapidly degrade wetlands by crowding out native species; spread rapidly across North America because of absence of its natural predators (beetles native to Europe); seeds may be dispersed by water, wind, and in mud attached to animals, or root or stem segments can form new flowering stems		http://www.inhs.uiuc.edu/edu/VMG/ploosestrife.html
Water hyacinth *(Eichhornia crassipes)*	Map: http://nas.er.usgs.gov/plants/maps/ei_crass.gif	Dense mats reduce spawning areas for fishes and shade out benthic communities; can nearly block the diffusion of oxygen through the water-atmosphere interface and kill fish		

<http://www.epa.gov/owowwtr1/monitoring/rbp/index.html>.

♦ *Redevelop waterfront sites that have been previously disturbed and expand existing marinas.*

Waterfront areas that have been previously used for industrial or military purposes might make good locations for new marinas because they have been developed before, usually have all the necessary infrastructure, and minimize disturbances to aquatic habitats. Many sites suitable for recreational boating facilities may be located in existing urban harbors where shorelines have been modified by bulkheading and filling. The adverse environmental consequences of redevelopment are usually minimal, and redevelopment can improve water quality, expand upland habitats, beautify and expand shorelines, and provide additional public access.

Waterfronts that are converted from water-dependent uses, such as marinas and recreational boating, to non-water-dependent uses, such as residences, office space, and shopping areas, reduce the availability of sites for marina development. To protect against such conversion in areas that contain important habitat, a state may purchase the property or the development rights from existing water-dependent uses. To preserve an existing marina, for example, a state government could pay the difference between the market value for other non-water-dependent development, such as for condominiums, and the water-dependent value of the marina to the marina owner, and receive in return a guarantee that the site would not be converted to a non-water-dependent use. States can use this method to retain sites suitable for marinas, maintain access for boating uses of the waterways, prevent conversion to other uses, and reduce the base value for property taxes.

The Hammond Marina (Indiana) was built on a derelict brownfield industrial site with a steel mill slag shoreline. The area is now a pleasant and protected boating facility with an attractive public access area, and it is popular as a sportfishing site. The local economy has benefitted from the redevelopment, and shorelines, upland habitats, and aquatic habitat at the site have been tremendously improved (USEPA, 1996: *Clean Marinas —Clear Value*).

♦ *Consider alternative sites where adverse environmental effects will be minimized or positive effects will be maximized.*

An analysis of alternative sites (sites other than the one proposed) can be used to demonstrate which site is the most economically and environmentally suitable. Analysis of alternative sites and designs has been effectively used to reduce the effects of development (including effects on tidelands, stream courses, shorelines, wetlands, and submerged aquatic vegetation) at many proposed marinas, and to find sites with flushing characteristics better than those at the sites initially proposed.

Many marinas built on freshwater lakes and rivers over the past two decades are located on what are known as brownfields, or shoreland that had been modified and seriously abused by previous industrial facilities. Usually, these areas support little to no natural vegetation or habitats when they are first converted to marinas. The marinas have turned these areas into recreational sites and public access points and have provided sheltered areas with protected shorelines, where natural vegetation has been able to reestablish itself.

♦ *Create new habitats or expand habitats in the marina basin.*

Almost any surface placed in coastal or inland waters, and especially rough surfaces—including rocks, piles, piers, and floats—quickly becomes home to a host of plants, animals, and bacteria. The submerged parts of breakwaters, piers, and floating docks are excellent examples of this kind of "created" habitat. The plants that colonize these surfaces provide refuge for a variety of invertebrates and are a good source of food for juvenile fish, which in turn can attract sport fish (Figure 4-7).

♦ *Minimize disturbance of riparian areas.*

Riparian areas are the narrow areas along the banks of rivers, streams, lakes, ponds, reservoirs,

Figure 4-7. Oak Harbor Marina sign. Oak Harbor Marina (Washington) has used its marina waters to raise salmon for release. Volunteers built salmon pens, and more than 420,000 salmon have been released as a result of the program. Deep River Marina (Connecticut) was the site for a 3-year federal/state stocking program for Atlantic salmon. The Puerto Rico Department of Natural Resources' Fisheries Office is located in Puerto del Rey Marina (Puerto Rico) and uses part of the facility's clean waters for an injured sea turtle rescue and recovery program (USEPA, 1996; *Clean Marinas–Clear Value).*

and wetlands. They may be vegetated, or may be beaches or rocky areas. Vegetated riparian areas extract nutrients from runoff from the land as it moves toward the waterbody and from the water that constantly circulates along the banks of the waterbody. The nutrients make them very productive habitats, with biodiversity and biomass typically higher than those of adjacent uplands. Many processes important to the health of waterbodies occur in vegetated riparian areas, including the following:

- Large quantities of nutrients are absorbed as waters pass through riparian areas.
- Eroded soils and other pollutants are filtered out of the water and absorbed by riparian vegetation.
- Nutrients are modified from forms that can't be used by aquatic organisms to forms they can readily use.
- The vegetation in riparian areas serves as a refuge for species for nesting, hiding from predators, and foraging.

Beaches and rocky shorelines also provide habitat variety and are important to many aquatic organisms. Because of the importance of all types of riparian areas to the general health of waterbodies, minimizing disturbances to them during marina development can be beneficial. Creating favorable conditions for the presence of riparian or wetland areas within a marina basin might be an effective, low-cost way to improve water quality in the basin or increase habitat diversity in the basin, depending on site conditions and space limitations.

♦ *Use dry stack storage.*

An alternative to building new docks for expanding boating access and marina capacity is to build dry stack storage facilities, in which many boats are stored on vertical stands on very little land. Boats stored in dry stack storage do not leak antifoulants to the water and can be more easily maintained on land in protected hull maintenance areas, providing less opportunity for spillage directly to surface waters. Dry stack storage has minimal environmental effects, and where zoning restrictions permit it, it is an appropriate means to increase public access to waterways.

BMP Summary Table 3 summarizes the BMPs for Habitat Assessment mentioned in this guidance.

BMP Summary Table 3. HABITAT ASSESSMENT MANAGEMENT

MANAGEMENT MEASURE: Site and design marinas to protect against adverse effects on shellfish resources, wetlands, submerged aquatic vegetation, or other important riparian and aquatic habitat areas as designated by local, state, or federal governments.

APPLICABILITY: New and expanding marinas where site changes might affect wetlands, shellfish beds, aquatic vegetation, or other aquatic resources or habitats.

ENVIRONMENTAL CONCERNS: The construction of a new marina in any waterbody type has the potential to disrupt aquatic habitats; these habitats include fish spawning areas, shellfish harvesting areas, designated wetlands, beds of submerged aquatic vegetation (SAV), or the habitats of threatened or endangered species. Design and locate marinas to help support aquatic plants and animals occurring in the waters before the marina's construction; operate marinas as a valuable habitat for plants and animals that do well in quiet, sheltered waters.

HABITAT ASSESSMENT PRACTICES

Best Management Practice Examples	Marina Location & Usage	Benefits to Marina	Projected Environmental Benefits	Initial Cost Estimate	Annual Operation & Maintenance Cost Estimate	Notes
Conduct habitat surveys and characterize the marina site, including identifying any exotic or invasive species	Marina basin and shores; recommended for new marinas or major expansions	MODERATE to LOW; might be required by federal or state laws	MODERATE to HIGH; minimizes adverse effects on aquatic life and habitats during construction and expansion	MODERATE to HIGH	NONE	State and/or federal agencies might have site-specific information; they might be willing to assist with site characterization; see EPA's web site, http://www.epa.gov/owow/monitoring/bioassess.html, for further information
Assess habitat function (e.g., spawning area, nursery area, feeding area) to minimize indirect effects	Marina basin and shores; recommended for new marinas or major expansions	MODERATE to LOW; might be required by federal or state laws	MODERATE; ensures that aquatic organisms can continue to use marina waters for special or seasonal habitat uses	HIGH to EXPENSIVE	NONE	
Use rapid bioassessment techniques to assess effects on biological resources	Marina basin and shores; recommended where bioassessment protocols have been established	HIGH to MODERATE; provides information about the biological health of waters	MODERATE; helps to determine whether a site is stressed by pollution or other factors, such as habitat alteration	LOW; requires training in aquatic invertebrate identification	LOW	
Redevelop waterfront sites that have been previously disturbed and expand existing marinas	Marina basin and shores; universally recommended for new marinas in urban areas	HIGH; previously developed sites usually have all necessary infrastructure for marina usage; redevelopment may expedite the permitting process and have lower land purchase/lease costs	HIGH; reduces pressure to use undeveloped shore; aids in cleanup of previous pollution; might improve water quality and shore and upland habitats	HIGH to EXPENSIVE	MODERATE to HIGH	Local zoning and planning changes might be required
Consider alternative sites where adverse environmental effects will be minimized or positive effects will be maximized	Marina basin and shores; generally recommended for new marinas	MODERATE to HIGH; analysis can help find more appropriate and economically suitable locations; potential long-term savings on environmental protection	HIGH; alternative sites are usually those with less sensitive environments, aquatic or shoreline flora and fauna, or better flushing characteristics	MODERATE to HIGH	MODERATE to HIGH	All reasonable potential sites should be considered before marina development

BMP Summary Table 3. (cont.) HABITAT ASSESSMENT MANAGEMENT

Best Management Practice Examples	Marina Location & Usage	Benefits to Marina	Projected Environmental Benefits	Initial Cost Estimate	Annual Operation & Maintenance Cost Estimate	Notes
Create new habitat or expand habitat in the marina basin	Marina basin; generally recommended	MODERATE to HIGH; "created" habitat can attract sportfish and improve fishing from shoreline or dock; improves marina appearance	HIGH; new habitats increase habitat diversity for more animals and plants and may cleanse runoff	MODERATE to EXPENSIVE	MODERATE to LOW	Riprap, new beaches in basin corners, and vegetated shorelines are examples of this kind of "created" habitat
Minimize disturbance of riparian areas	Marina basin and shores; universally recommended for new marinas or major expansions	MODERATE; retaining riparian or wetland areas within a marina basin can be an effective, low-cost means to improve water quality and reduce construction costs	HIGH; riparian areas cleanse runoff and basin water; improves and diversifies habitat for plants and animals	MODERATE to HIGH	MODERATE to HIGH	Riparian areas are the narrow vegetated areas along the banks of rivers, streams, lakes, ponds, and reservoirs. They are very productive and are important habitats for many land and aquatic animals. They are critical landscape elements.
Use dry stack storage	Marina land and docks; recommended wherever space and local ordinances allow	HIGH; can reduce all types of marina-related pollution in the marina basin	HIGH; reduces habitat disturbance in the marina basin	HIGH	MODERATE	Dry rack storage is applicable to shallow draft and low-height powerboats of less than approximately 40 feet LOA; use may require zoning changes; may conflict with scenic vista issues; increases upland impervious surface area